Effect of Economic Recovery and Adjustment Policies on The Friedman-ball Hypothesis and The Cointegration of Inflation and The Uncertainty of Inflation in Africa.

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Abstract

This paper examines the possible effects of World Bank and IMF economic recovery policies on the long run relationship between monthly inflation rates and the uncertainty of inflation in three Sub-Saharan African countries. We selected Senegal, Ghana and Uganda for this investigation because at a point they were considered by IMF and World Bank to be the more promising among African countries in their efforts to emerge from economic stagnation. Based on a GARCH (1, 1) framework, we generate a time series of conditional variances of inflation as proxies for uncertainty of inflation and use cointegration techniques to determine existence of a long run relationship with inflation rates. We examine the latter relationship within the context of the Friedman-Ball Hypothesis. GARCH results show persistence in volatility which provide evidence of the presence of both ARCH and GARCH terms in inflation rates of all countries and across all economic regimes. Also, the outcome of cointegration results show long run equilibrium links between inflation rates and its uncertainty. Senegal and Uganda provide strong empirical support for the Friedman Ball hypothesis. Evidence from Ghana is mixed and seems to reflect the impact of new policy initiatives in the adjustment era.

Introduction

Sub-Saharan African (SSA) countries have faced a myriad of economic downturns and generally poor macroeconomic performance over the last few decades. The factors listed as the cause for the latter have ranged from political instability, economic mismanagement to natural disasters. Within the context of the general economic malaise that has dogged Africa lie the varied histories of economic performance of individual countries in SSA. Under the auspices of the World Bank and IMF, various SSA countries adopted economic recovery (ERP) and structural adjustment (SAP) programs with a view to improving their economic circumstances. The objectives of most of these programs were to control inflation, enhance real growth rates through increased investment and savings, tighten fiscal discipline and improve intermediation by reforming the financial sector. Some countries responded positively to these measures and saw improvements especially in inflation control and economic growth. According to an IMF survey paper three of such SSA countries that demonstrated promise were Ghana, Senegal and Uganda, which are the focus of this study.[1]

The macroeconomic variable impacted by the various adjustment programs adopted by the above SSA countries, and of interest to this study, is inflation rate. During the periods of reform for Ghana, Uganda and Senegal, the levels of inflation in the respective countries were lowered and in fact in some situations in very dramatic fashion. Between 1983 to 1991, inflation in Ghana went from 123% to 10.3%, in Uganda inflation went from 237% in 1986/7 to 3.4% in 1994/5 and in Senegal inflation dropped from 9.8% for the period 1978-84 to -0.4% between 1989-93.[2] As indicated earlier, these changes in the levels of inflation coincided with the adoption of various economic policy adjustments programs and these appear to have created different inflation regimes in each of the three countries respective economic histories. In line with existing literature on the subject matter of this paper, we investigate whether the changing economic policy regimes experienced by the three countries affected the long run relationship between inflation and inflation uncertainty.

Theoretical arguments have been presented by Friedman (1977), and Ball (1993) on the relationship between inflation and the uncertainty of inflation. They posit that generally high inflation causes inflation uncertainty. The main thrust of their argument centers on the uncertainty on the part of agents in an economy trying to gauge the preferences of monetary policymakers toward inflation and the policy responses to rising rate of inflation. The literature provides empirical evidence in support of the endogeneity of the uncertainty of inflation in its relationship with average inflation (Grier and Perry (1998), Tevfik and Perry (2000), Grier and Grier (2006), Thornton (2007), Payne (2008 and 2009) and Kesket and Orthan (2010) among others). This paper assumes the framework of Friedman–Ball hypothesis as we investigate the long run relationship between inflation and inflation uncertainty. By implication, we directly test the efficacy of the Friedman-Ball hypothesis in the three SSA countries.

The results of the GARCH (1,1) tests display persistence in volatility which confirms the presence of both ARCH and GARCH terms in all countries and across all economic regimes. The outcome of cointegration regression procedures shows evidence of the long term equilibrium relationship between the conditional variance of inflation and inflation rates. Senegal and Uganda provide strong empirical evidence in support of the Friedman-Ball hypothesis. This evidence appears to be robust to the influences of the changing economic regimes. Evidence from Ghana is mixed and seems to reflect some impact of the implementation of economic recovery policies.

The rest of the paper will be presented as follows; overview of the literature on inflation and the uncertainty of inflation followed by discussion on the recovery and adjustment programs adopted by Ghana, Senegal and Uganda, following that we will present the econometric model and results and then present implications and conclusions of the study.

Overview of Inflation and Uncertainty of Inflation

Most finance and economic variables are quoted in nominal terms and therefore the behavior of inflation is fundamentally relevant to the anticipated path of these variables. This renders the unpredictable or uncertain aspect of inflation even more important in the behavior of nominal

[1]IMF Survey (November 11, 1996)
[2]Adjustment for Growth: The African Experience (Hadjimihael, Nowak, Sharer and Tahari, 1996)

data (Ireland (1996); Mishkin (1990a & 1990b); Frenkel and Lown (1994)). Specifically, the path of a crucial variable like market quoted nominal interest rate is important to decision making at all levels. The important role interest rates play in the process of asset valuation serves to underscore the importance of factors that influence its path. Business and individual decisions on investments are largely predicated on the direction of rates. Therefore, given that real rates hardly changes, the uncertainty aspect of inflation rates may tend to influence reactions to the expected path of interest rates. So, knowing the relationship between inflation and its uncertainty, at a minimum, equips investors at all levels with additional information with which to gauge the predictability of rates and consequently what appropriate decisions to make.

Various studies have attempted to establish the relationship between inflation and its uncertainty (Ball, Cecchetti and Gordon (1990); Evans (1991, 1993); Evans and Wachtel (1993); Holland (1993 & 1995); Golob (1994) among a others). In an earlier study of 17 OECD countries from 1951 – 1968 and using standard deviation as a gauge for inflation variability, Okun (1971) reported that countries with average high inflation tended to display higher variability in inflation. In a related study, Logue and Willett (1976) using 41 industrialized and developing countries found over the period of study from 1950-1970 a positive relationship between inflation and its variability. However, upon disaggregating the sample into industrialized and developing countries in a regression model, reported that the some economies in the industrialized economies displayed a negative coefficient. The authors reasoned that the results may reflect more effective monetary policy measures in periods of increasing uncertainty in the industrialized countries as against developing ones. Like Okun they used the standard deviation of inflation as proxy for variability and uncertainty of inflation. The use of standard deviation as proxy for inflation uncertainty does not always fully capture actual uncertainty since in certain cases variability is predictable (Grier and Perry (1998)). Subsequent efforts to capture true inflation surprise and uncertainty entailed the use of variations of ARCH/GARCH models to extract and generate conditional variances of the error term of autoregressive models of inflation rates (Engle (1983); Bollerslev (1986); Grier and Perry (1998); Nas and Perry (2000); Fountas, Loannidis and Karanasos (2003) and Bhar and Hamori (2004)[3]. In large part, as stated earlier, tests conducted established a positive relationship between inflation and its uncertainty.[4] Grier and Perry (1998) Ball (1992) after obtaining a series from a GARCH model representing inflation uncertainty for G7 countries, employed Granger Causality procedure to test the direction of causality between inflation and its uncertainty. Results indicated that inflation rates raises inflation uncertainty in significant fashion. This provide support for the Friedman-Ball Hypothesis. Evidence establishing a reverse relationship, i.e. inflation uncertainty to inflation connection, was frail and inconclusive.

Taking account of the results and findings reported above and how policy differences across countries influence the relationship between inflation and its uncertainty, the special economic experiences of the SSA countries in this study affords an opportunity to further examine the tenancy of inflation-uncertainty relationship over changing policy regimes. As stated by Bhar and Hamori (2004), the nature of the relationship between inflation and its uncertainty appear to differ from country to country within the European Union (EU) so, given the peculiar macroeconomic policy paths of Ghana, Senegal and Uganda it be will interesting to investigate the long run behavior of the inflation-uncertainty of inflation relationship as policy regimes changed.

Economic Path to Growth and Development: Ghana, Senegal and Uganda.

Ghana, Uganda and Senegal at some point in their economic histories adopted IMF and World Bank sponsored programs of economic reform and structural adjustments. These three countries were faced with typical problems besetting not only African economies but most developing countries. Namely, these problems were; excessive government intervention in their respective economies leading to an inefficient and distorted resource allocation mechanism in their respective economies with direct implications on growth of the private sector; low savings rates and investment inflows which further stifled sustained growth; low productivity and increasing exposure to external shocks.[5] Complicating the latter economic issues were a plethora of political problems and excessive vulnerability of the agriculture sector to the vagaries of weather. Collectively, these problems resulted in low growth, high government deficits, high inflation, a stunted financial sector and a generally unstable macroeconomic environment.

In adopting reform and structural adjustment programs, Ghana, Senegal and Uganda objectives were to improve macroeconomic environment by lowering and stabilizing inflation, removing price controls, promoting domestic savings to supplement meager foreign investment, reducing import and export tariffs and promote trade, remove exchange rate controls, efforts to improve, enhance and grow the financial sector, generally reducing government participation in the economy except government investments and measures to facilitate the growth of the private sector. The impact of these measures on the economic circumstances of the three countries was generally described as positive, however, each country experienced different degrees of success and below is a summary of achievements.

Ghana: Over the period of reform, i.e. 1983 – 1991, Ghana appears to have made some progress in some of the problem areas outlined above. While encouraging private savings, the country significantly reduced trade restrictions, liberalized and removed controls on exchange rates. The result was a positive change in national savings from -7.6% in the pre-adjustment period (1970-83) to 8.7% over the adjustment period (1983-91) and also, export as a percentage of GDP increased from 2% in 1982 to 17% in 1987. Efforts to enhance productivity seem to have been fruitful, productivity went from -2.57% from 1976-82 to 2.22% for the 1983-86 and eventually to 2.48 from 1987-91. Additionally, real GDP growth went from -1.6% during the pre-adjustment period (1978-83) to 3.6% during the first half of the adjustment program (1983-86) to 4.8% in the second half (1987-91).[6] Of particular interest to this study was the impact of the reform and adjustment measures on inflation, over the period of adjustment the annual inflation rate went from 122.88% in 1983 to 18% in 1991 and to 10% in 1992. The purpose of this study will be to determine the direction of inflation-uncertainty of inflation relationship of Ghana before, after the reform and adjustment measures were put in place.

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[3] Evans, M. (1991) shows that the changing behavior of agents and policymakers toward inflation can precipitate 'both ARCH effects and time variation in the structure of inflation.'

[4] Bhar and Hamori (2004) examine the inflation and uncertainty relationship using a markov switching model on G7 countries and reported that the relationship depended on whether the shock was transitory and differed by country.

[5] Hadjimichael, Nowak, Sharer and Tahari (1996)

[6] Nowak, Basanti, Horvath, Kochhar & Prem(1996) Ghana, 1983-91.

Senegal: Between 1974 and 1977, Senegal experienced relatively strong economic growth of 5% which was largely motivated by good weather and increased exports. This was followed by a period of declining agriculture production due to poor weather conditions, macroeconomic uncertainty and a slow economic growth of 2%. During 1978 – 1984, Senegal adopted adjustment programs supported by the World Bank in an attempt to arrest the deteriorating economic situation but results were weak and not particularly successful. Efforts were revamped and more rigorous adjustment measures were put in place from 1985-1988 and this led to improvements in the trade balance and economic growth increased to 4% a year. Measures taken during this period involved financial restructuring and injecting fiscal discipline in managing the economy. In the final period of the third phase of the adjustment period, i.e. 1989-93, economic circumstances deteriorated again with growth averaging below 1%. Over the entire adjustment period (1978-93) inflation went from 3.4% in 1978 to -0.59% (IFS) in 1993.

Uganda: After a lengthy and brutal civil war that ravaged and virtually paralyzed the Ugandan national economy, the country adopted structural and reform policies to rebuild the infrastructure and correct severe economic imbalances. Inflation in 1987 was in the region of 200%, the economy was almost dependent upon coffee production, real GDP growth rate were -2.4% and 0.3% in 1984/5 and 1985/6 respectively, currency was overvalued within the fixed exchange rate regime reducing the country's competitiveness and the country faced deteriorating terms of trade. Over 1987-95, the country embarked on adjustment programs which included trade and exchange rate liberalization, removal of price controls, rationalizing state employment levels and fiscal discipline. The latter effort resulted in an increase in the real growth rate from 3.8% in 1987 to about 10% in 1995 averaging about 6.4% a year,[7] a realignment in the value of currency thereby improving the external competitiveness, trade increased by 2.6% in 1986/7 to 21.6% in 1994/5 and inflation was reduced from about 200% to 3.4% in 1994/5. Uganda also registered progress in areas of national savings and fiscal deficits. The country's efforts and progress has been described as one of the significant success stories in SSA.

Clearly, progress was made in all three countries but Ghana and Uganda appeared to have benefited more from the adjustment programs. The question to be examined is to determine how the policy effects on inflation affected the nature of the long run relationship between inflation and its uncertainty.

Inflation Uncertainty and The Garch Model

Data-wise, the tests conducted are broadly divided into two; first we delineate the data of each country into two main periods, namely, pre-adjustment period, post adjustment period and then entire data set encompassing both regimes. For the period by period aspect of our examination, based on autocorrelation, total R-Square and likelihood ratio tests we assumed that inflation rates in the three countries follow an AR(1) process to obtain the conditional mean and GARCH (1, 1) model was the best amongst alternatives considered to generate the conditional variances as gauges for inflation uncertainty.[8] Lag lengths were based on Sims (1980) likelihood ratio test.

The employment of a GARCH framework for this study follows publications by Grier and Perry (1998) Nas and Perry (2000) and Fountas *et al* (2003), among others, and the effort to capture better gauges of inflation uncertainty than the standard deviation of inflation rates. As explained earlier, the latter approach may fail to discount the predictable aspects of the standard deviation of inflation and therefore provide an inaccurate estimate of inflation uncertainty. In a similar vein, efforts to capture the uncertainty of inflation from standard deviations of survey responses to inflation expectations tends to lead to an underestimation of inflation uncertainty. The latter occurs due to the observed tendency of survey respondents to give similar estimates of inflation regardless of their actual future expectations of the path of inflation.[9]

The GARCH (1, 1) framework, described by Engle (2001) as 'the simplest and most robust of the family of volatility models,' side steps the short comings of the previously stated approaches and provides a measure of uncertainty of inflation presented by Ball (1993) and Cukierman and Meltzer (1986). The AR (1) – GARCH (1, 1) model employed in this study is as follows:

$$Inf_t = \delta_0 + \sum_{i=1}^{p} \delta_i \, Inf_{t-i} + \varepsilon_t \qquad (1)$$

$$\sigma^2_{\varepsilon t} = \alpha_0 + \alpha_1 \varepsilon^2_{t-1} + \alpha_2 \sigma^2_{\varepsilon t-1} \qquad (2)$$

Equations (1) and (2) are the general GARCH (1, 1) framework which assumes that residual variance of inflation follows an AR process.

Stationarity of Inflation Data

We used the Dickey-Fuller (DF) and Phillip Peron (PP) to test for stationarity, and results at the 5% level for all regimes confirm the inflation and subsequently, conditional variance series for all the countries and across all regimes to be stationary.[10] In the case of Senegal, both series for all regimes except for the conditional variances of the pre-adjustment regime are stationary. Upon differencing by order one (d=1), Senegal's pre-adjustment conditional variance series rejected the null of non-stationarity.

Regime estimates of the AR (1) - GARCH (1, 1) Model

Below are estimates of the AR (1) –GARCH (1, 1) mode based on equations 1 and 2. Results in tables 2a – 4b show persistence of the ARCH term across the different regimes and in all the countries. Also, the GARCH term display consistent volatility clustering in all countries and across all the economic regimes. This is especially so in the post-adjustment era and in the entire sample. The outcome of AR (1) - GARCH (1, 1) tests shows persistence in volatility confirming the presence of both ARCH and GARCH effects over the period of study.

[7] This was higher than the average of 1.6% in SSA (Hadjmichael et al, 1996, P. 5).
[8] We looked higher order GARCH models like GARCH(2,2) and different combinations thereof but found GARCH(1,1) to be better suited.
[9] Zarnowitz and Lambros (1987) provide an indepth examination on what they describe as 'consensus' forecasts.
[10] We report DF results since PP provided similar outcomes.

Graphs of the series of time varying variances of inflation as proxies of uncertainty obtained from AR(1)-GARCH (1,1) process (the CV series) and inflation rates for the three countries appear to visually underscore in general, the positive relationship between the two variables. Figures (1) – (3) map the relationship between inflation and the uncertainty of inflation over the economic regimes for the countries.[11] Also, visual indications from the graphs, especially in Ghana and Uganda show that over the policy periods the levels of inflation and the uncertainty of inflation decreased.

Figure 1

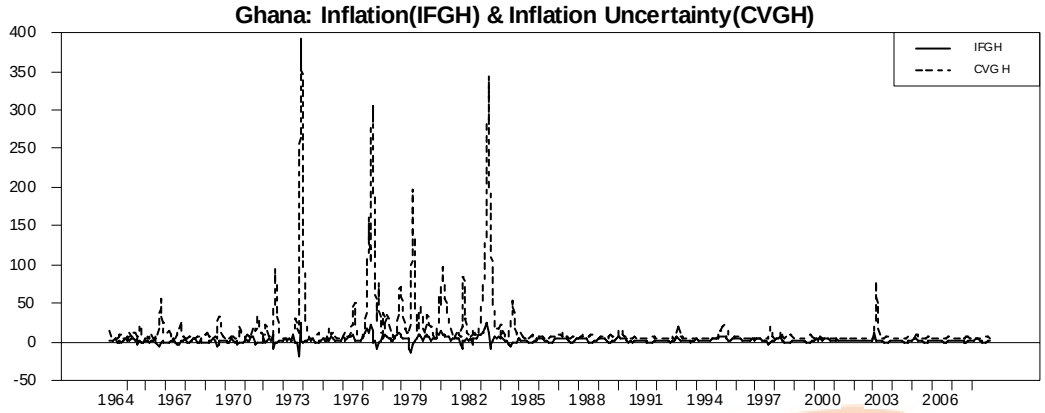


Figure 2

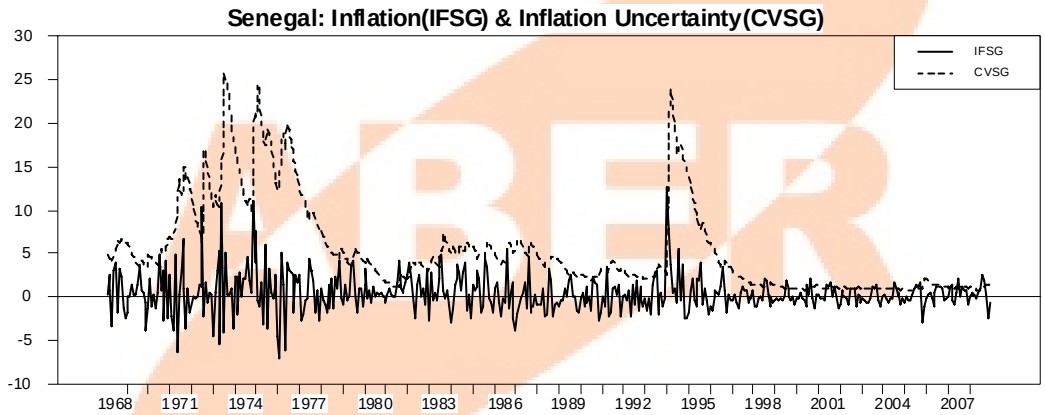
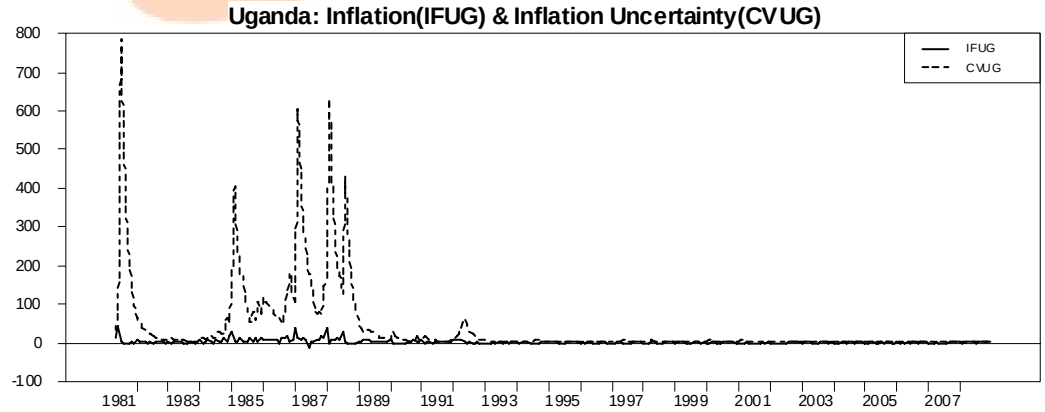


Figure 3



Empirical Model, Stationarity and Cointegration

This paper tests the long term relationship between monthly inflation rates and the uncertainty of inflation. We investigate this possible link within the context of the Friedman-Ball hypothesis which posits the endogeneity of the uncertainty of inflation in its relationship to inflation rates. This proposition is examined for the three countries both before and after the formal engagement of IMF and World Bank economic adjustment and recovery programs. The testable proposition is as follows:

[11] 'CV' in the graphs represent the conditional variance which is a proxy for the uncertainty of inflation and 'IF' is monthly inflation rates.

Stationarity Test of Monthly Data

Table 5: Results of Dickey-fuller (T-statistics) Test For Inflation

PERIOD	GHANA	SENEGAL	UGANDA
Pre-Adjustment	-6.72** N=224	-13.01** N=119	-6.78** N=67
Post-Adjustment	-8.51** N=310	-14.99** N=372	-6.46** N=262
Overall	-10.37** N=536	-14.27** N=490	-6.81** N=330

**Rejection of null hypothesis of non-stationarity at the 5% level.
* Non-rejection of null hypothesis at the 10% level.
DF: Dickey-Fuller

Stationarity Test of Monthly Data

Table 6: Results of Dickey-fuller (T-statistics) Test For Inflation Uncertainty (conditional Varianace)

PERIOD	GHANA	SENEGAL	UGANDA
Pre-Adjustment	6.21** N=224	-2.49 N=118	-3.55** N=67
Post-Adjustment	-6.64** N=310	-3.55** N=114	-7.18** N=263
Overall	-8.89** N=536	4.31** N=489	-6.19** N=331

**Rejection of null hypothesis of non-stationarity at the 5% level.
* Non-rejection of null hypothesis at the 10% level.
DF: Dickey-Full
For both variables Results of Phillips-Perron Stationarity tests provided even stronger confirmation of stationarity.

Table 7: Results of Dickey-fuller's Cointegration Test Based on The Stationarity of The Residuals (N_t) of Equation (2)

PERIOD	GHANA		SENEGAL		UGANDA	
	β_t	v_t T –stats	β_t	v_t T-stats.	β_t	v_t T-stats.
Pre-Adjustment	0.67 L=2 (1.05)	-6.30** N=222	0.31* L=1 (1.93)	-2.46 N=117	10.16** L=2 (5.74)	-4.00** N=201
Post-Adjustment	-5.40** L=2 (12.38)	-6.93** N=105	0.61** L=2 (6.25)	-3.18** N=368	13.33** L=1 (18.36)	-8.38** N=73
Overall	2.26** L=2 (5.58)	-9.35** N=534	0.53** L=2 (5.00)	-2.99** N=487	11.14** L=2 (15.67)	-6.35** N=261

T-stats: DF T-test values for Stationarity Test of the Residuals.
** Rejection of null hypothesis of Non-Cointegration at the 5% level based on DF t-test values.
* Rejection of null hypothesis of Non-Cointegration at the 10% level.
L : Lag Length.

Conclusion

Empirical evidence show that potentially inflation uncertainty negatively impacts economic activity by elevating risk premia and increasing contract costs, lowers output growth and exacerbate levels of unemployment(Reagan and Stulz (1993), Seyfried and Ewing (2001), Grier and Grier(2006), Wilson (2006) and Thornton, (2007)). This underscores research interests in the subject matter of inflation and inflation uncertainty at all levels of decision-making, from managerial business decision-making to sovereign economic policies at the national level. This paper contributes to this discourse by considering the impact of IMF and World Bank economic policies on the relationship between inflation and the uncertainty in three African countries, Ghana, Senegal and Uganda. These countries were generally considered to be relatively successful in their efforts at positively re-aligning their respective economies.

We employ a GARCH model to generate conditional variances of inflation as proxies for inflation uncertainty in a test to determine whether there exist a long run relationship between inflation rates and the uncertainty of inflation. The period of study was divided into pre-adjustment and post-adjustment regimes. Additionally, we examine the relationships between the two variables within the context of the Friedman-Ball hypothesis. The hypothesis basically postulates the endogeneity of the uncertainty of inflation in its relationship with inflation rates. Results of the GARCH(1,1) tests display persistence in volatility and provide evidence of the presence of both ARCH and GARCH terms in all countries and across all economic regimes.

The outcome of cointegration regression underscores, in significant fashion, the long term equilibrium relationship between the conditional variance of inflation and inflation rates. Results in Senegal and Uganda provide strong evidence in support of the Friedman-Ball hypothesis. This evidence appears to be robust to the influences of the changing economic regimes. Evidence from Ghana is mixed and seems to reflect some impact of the implementation of economic recovery policies. Contrary to the Friedman-Ball hypothesis, the negative coefficient obtained in the post-

adjustment era suggest an inverse relationship between inflation and the uncertainty of inflation. This may be due to the lagged misalignment between the two variables as a result of the prosecution of monetary policy in the enhanced disciplined regime under the IMF and World Bank economic programs with the aim of lowering inflation and ultimately reducing the levels of uncertainty as captured by the graphs. The realization of the latter macroeconomic objectives in most of the countries in this study, has the benefit of contributing to the creation in the respective countries of more stable and enabling environments for effective business planning and decision-making.

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